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THE
NEW ZEALAND ENTOMOLOGIST

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Plusia chalcites on *Tecomanthe speciosa*

By J. S. EDWARDS

Department of Zoology, Auckland University College

This short note extends the host range of *Plusia chalcites* Esp., Schmett, and is the first record of insect damage to *Tecomanthe speciosa* Oliver. From the single known wild specimen of *T. speciosa* growing on Great Island, Three Kings, discovered in 1945 by G. T. S. Bayliss (Oliver, 1948, *Rec. Auckland Inst. Mus.* 3; 4 & 5: 233) cuttings have been propagated and one of these now in the grounds of Auckland University College, has been growing luxuriantly there since August, 1955.

In May, 1956, eaten leaves were first noticed and pupae were found on the undersides of the large, karaka-like leaves. These proved on emergence to be *Plusia chalcites,* a species well known for its broad range of food-plants. In an environment providing an abundance of the known hosts of *Plusia,* it extended its range within the first summer of the presence of a new potential host.

Notes on *Ischnura aurora* (Brauer), Odonata

By J. S. ARMSTRONG

3 Titiraupenga Street, Taupo

This, the smallest but most beautiful of our dragonflies, has been recorded by Tillyard (1927) as "Occuring throughout Australia, Norfolk, Lord Howe and Kermadec Islands as well as occasionally in New Zealand". No other record of its occurrence in New Zealand has been found.

The male has such vivid colouring with its bronze-black thorax marked with narrow grass-green antehumeral stripes and green sides, the abdomen bright red for the first six segments followed by black with sky-blue on the posterior half of the eighth and whole of the ninth segments, that once seen it is easily remembered. The female colour is in shades of dull green for the most part.

A single male was seen at "Two Mile Bay" Lake Taupo on 13.12.36. This was the only occasion on which I have seen the species in the Taupo district since I came to live here in 1926 until this year, when I found it breeding in large numbers in the Waitahanui district.

I. aurora has been breeding in several places in Hawke's Bay since 1941, such as the stream below the Tangoio Maori Reserve and streams as far south as the Waipawa River, where a pair was seen in flight as early as December 9.

I would like to know of any other localities where this species has been found in New Zealand and where breeding was noted or suspected.

The range of the red coloured race of *I. aurora* extends from the hills of Southern India over Australia to New Zealand and Samoa, which is remarkable in so small an insect; its dispersal may have been assisted by some peculiarities that it seems to have developed in its breeding habits together with its ascending up into the upper atmosphere, where it may be dispersed by the air currents.

Measurements.—Male: abdomen, 20–21 mm; hind wing, 12–13 mm. Female: abdomen, 19–20 mm; hind wing, 13–14 mm.

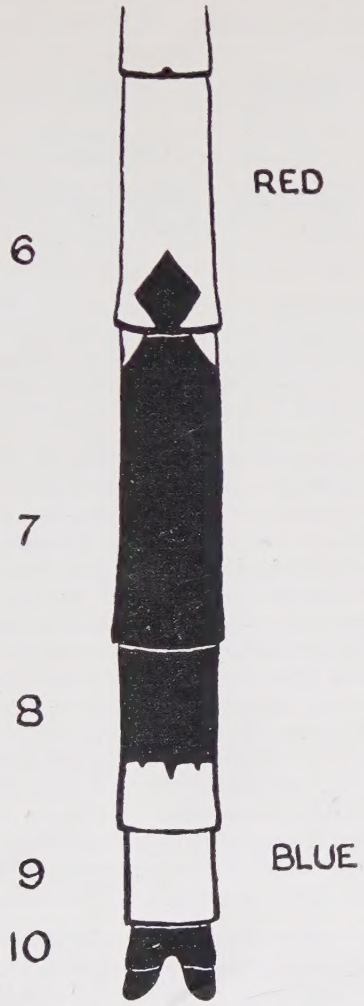

FIG. 1. *Ischnura aurora* (Brauer), terminal segments of abdomen of male.

Observations of Some Habits and Early Development of *Melampsalta cingulata* (Fabr.)

Order HEMIPTERA. Family CICADIDAE.

By B. HARFORD

Department of Scientific and Industrial Research, Entomology Division, Nelson.

In early December, the first *Melampsalta cingulata* adults appear; there is a steady growth in population until late January and early February, when the peak of adult appearance is reached. After the end of February populations begin to dwindle, until by the end of March few adults are to be seen or heard.

Soon after the beginning of December, males may be heard in their characteristic frequent bursts of song, until later in the summer months, when the volume of sound becomes almost deafening in places where they are very abundant. Temperature and light are the most important factors in regulating singing habits of *M. cingulata,* as is mentioned for other species by Myers, 1929. For the purpose of singing, trees in sunny situations are favoured, so that forest on the side of a hill lying to the sun shows ample evidence of their activity, while the shaded side is visited by cicadas to a lesser extent. During warm rain males continue to sing until the temperature drops and on warm moonlight nights odd individuals have been heard singing for short periods. It is their normal habit to sing only during sunlight, and during the peak period singing commences at sunrise and continues until sunset. Each day during early March, the length of time for singing is reduced, until finally only three or four hours in the middle of the day are occupied by irregular periods of song. Odd individuals may sing until the first week in May.

Similar conditions are required for oviposition as described above for singing. By February, females have commenced oviposition in branches of small diameter on native and exotic trees and shrubs. Oviposition sites most frequently selected are in more or less vertical growth, while on a twig that is approximately horizontal, the under surface is preferred. Oviposition occurs on a wide range of hosts, of which it has not been possible to include more than a fraction of the probable botanical coverage; the appendix contains a list of plants which have been noted in order of preferential selection of hosts. A noticeable feature of this list is the absence of exotic gymnosperms, which do not appear to be suitable for oviposition.

Oviposition areas (OA, Fig. 1) may be identified by the characteristic " herring-bone " pattern of egg chambers. With the body parallel to the length of the twig, the female grips the bark with her tarsi and is then ready to commence oviposition. She moves her abdomen to one side, inserting the ovipositor (Op. Fig. 1) through the bark to just beneath the cambium layer. The insect moves slightly backwards, forcing her ovipositor into the wood-tissue at an angle of approximately 8° to the surface of the twig. This is continued until the ovipositor has penetrated about 1 cm into the plant tissue. The cavity so formed is circular in section and has a diameter of nearly 0·9 mm. The female *M. cingulata* now moves forward, slowly withdrawing the ovipositor and laying the eggs. These are laid and packed into two alternate rows in the bottom half to two-thirds of the cavity. The eggs are usually placed at an angle of about 9° to 12° to the length of the cavity or egg chamber (EC, Fig. 1). They are packed in so firmly that an impression is left in the surrounding woody tissue and dislodgment by vibration is almost impossible. When the ovipositor is completely withdrawn from the twig, the female moves her abdomen over to the opposite side and repeats the process by inserting her ovipositor just above the entrance to the previous cavity. In this way a pair of egg chambers is formed, arranged in a " V " pattern. When each pair is repeated several times one above the other, the completed oviposition area takes the normal " herring-bone " form. The bark is usually broken, sometimes exposing the whole area of ruptured wood-tissue, but disruption varies according to the host—e.g., *Ribes grossularia* and *Rubus australis* show this character especially. In successive years, scars on the wood gradually heal, so that on a preferred host cicatrices at all stages of healing may be seen.

One hundred oviposition areas, ranging over 32 different host plants, were dissected, and the following figures were obtained:—

	Minimum	Maximum	Average
Length of oviposition areas	1.1 cm	9.7 cm	4.4 cm
Diameter of twig	1 mm	19 mm	6 mm
No. of pairs of egg chambers per oviposition area	1	13	6
No. of eggs per egg chamber	4	21	13

Coincident with a variation in twig diameters is a variation in angle between two egg chambers forming a pair; if the diameter of the twig is smaller the angle is less; so that with the same number of pairs of egg chambers, the length of the oviposition area varies according to the diameter of the twig—e.g.:

	Host 1	Host 2
No. of pairs of egg chambers	4	4
Length of egg chamber	1 cm	1 cm
Diameter of twig	4 mm	6 mm
Length of oviposition area	3.7 cm	2.4 cm
Angle between 2 egg chambers forming a pair	26°	32°

Many branches disposed vertically on *Coprosma* spp. were observed showing the arrangement of pairs of egg chambers in a "V" pattern in some oviposition areas, while in others the "V" markings were inverted; this suggests that the species does not oviposit in one characteristic direction.

Often an empty pair or occasionally up to as many as two pairs of egg chambers, are made before the cicada leaves the oviposition area. These empty chambers are usually to be found at the base of a column of "V" pairs, or if the pattern is of inverted "V" markings, the empty chambers are at the top of the column; when the pattern is reversed these chambers still occupy the same relative position. Single egg chambers and pairs of egg chambers may be found together, but rarely is this so. When oviposition has commenced close to a node which presents an obstruction, egg chambers are continued again on the next internode. Frequently areas are seen which consist merely of one or two pairs of egg chambers spread along the twig at irregular intervals, suggesting that the host is not attractive, either because of thorns as on *Crataegus oxyacantha,* or owing to short-length internodes, as in *Carpodetus serratus.*

Oviposition produces weak areas on twigs of some young trees, especially *C. serratus*, when lateral or even main branches can be broken by wind (Ranger, 1945). Even death of trees can result when massive populations of *M. cingulata* are present (D.S.P., 1957). In some cases severe injury has been recorded on fruit trees growing in areas of bush, (Atkinson et al, 1956).

On twigs of very small diameter, oviposition "herringbone" patterns are not possible, egg chambers being placed singly, at a slight angle to the length of the twig, as in such twigs on *Coprosma baueri* and *Rubus australis* for example. A greater length of twig is thus covered, to give sufficient space for the required number of egg chambers. The latter species provides an example where extreme length is as follows:—

Diameter of twig	1 mm
Length of oviposition area	31.1 cm
Number of single egg chambers	37

The eggs are elongate—elliptical, occasionally slightly curved, depending on the pressure exerted on them by adjacent eggs. The chorion is transparent and the contents are milky-white. From a random sample of 20 eggs average measurements were:—

Length	1.74 mm (variations from 1.65 mm to 1.81 mm)
Diameter	.42 mm (variations from .37 mm to .4 mm)

Eggs begin to taper ·37 mm from each end to the rounded ends. A few examples were noticed of dead blackened egg masses, for which no special cause could be found.

Twigs showing egg-laying scars were collected from the beginning of the oviposition period, but it was not until April that development was noticed within the egg, when orange-red coloured "eye" spots appeared apically, while the remaining contents began to assume the same tint which showed through the chorion. Body segmentation became discernible and the formation of legs commenced. This condition was apparent in eggs deposited in twigs of *Ribes grossularia, Humulus lupulus* and *Rubus australis,* none of which exceeded 3 mm in diameter. From these eggs, nymphs commenced to emerge during the last week of July, while in other hosts collected at the same time, the orange developmental colour was still absent.

When nymphs are ready to emerge, the chorion is split down the anterior half, extending from here across the top and down the opposite side for a distance of no more than one quarter of the length of the egg. The chorion remains in its original position in the egg chamber, while the orange coloured larva wriggles out to the surface of the wood. The larva is extremely active and walks along the twig, finally dropping to the ground, where it runs around vigorously and which it then enters for the next stage of its life history.

During the course of investigations of the early development of *M. cingulata* a previously unrecorded hymenopterous parasite was observed. In the adult of this parasite, the head, thorax, abdomen, antennae and legs are black while the eyes are dark brown in colour.

The female parasite (Fig. II, left) deposits an egg in the egg chamber of *M. cingulata.* On emerging, the hymenopterous larva consumes the entire egg contents in the egg chamber and turns so that the head end is closest to the surface of the twig, and in this position it pupates. The contents of one egg chamber appears to provide sufficient food for complete development of the larva. This larva (Fig. 11, right) is semi-transparent, whitish, rounded anteriorly and pointed terminally, while it may measure up to 4 mm in length. It remains inside the egg chamber during winter and pupates in the following season. Adults emerge in the summer and force their way through the fibres of the egg chamber to the outside.

These parasites have been observed in several areas in the Nelson district. They were associated with *M. cingulata* oviposition areas on the following host plants:—*Myrtus bullata, Cotoneaster sp., Hebe salicifolia, Crataegus oxyacantha, Hedycarya arborea, Aristotelia serrata, Fuchsia excorticata, Berberis darwinii, Dacrydium cupressinum, Rubus australis, Melicytus ramiflorous, Carpodetus serratus, Fraxinus excelsior, Coprosma sp.* and *Olearia sp.*

APPENDIX

Plant Host List of *M. cingulata*

Group 1.—Preferred hosts showing old and new oviposition areas, often forming continuous " herring-bone " oviposition sites with only a short length between each area.

Carpodetus serratus Forst.	Putaputaweta
Cornus capitata Wall.	Strawberry tree
Gingko biloba Linn.	Maiden-hair tree
Ilex spp.	Holly
Melicytus ramiflorus Forst.	Mahoe
Myrtus bullata Sol. ex A. Cunn.	Ramarama
Ulmus sp.	Elm
Coprosma spp.	
Podocarpus totara D. Don	Totara
Chimonanthus praecox (Linn.) Link.	Winter-sweet
Rosa canina Linn.	Dog-rose
Camellia spp.	Camellias
Cotoneaster sp.	Cotoneaster (orange-berried)
Pittosporum tenuifolium Banks & Sol. ex Gaertn.	Kohuhu

Group 2.—Hosts having many scattered oviposition areas.

Nothofagus menziesii (Hook. f.) Qerst	Red beech
Aesculus hippocastanum Linn.	Horse chestnut
Cytisus scoparius Link.	Common broom
Nothofagus solandri (Hook. f.) Qerst	White beech
Rubus australis Forst. f.	Bush-lawyer
Paratrophis microphylla (Raoul) Cockayne	Milk-tree (adult or juvenile forms)
Myrtus obcordata (Raoul) Hook. f.	Myrtle
Leucopogon fasciculata (Forst. f.) A. Rich.	Mingimingi
Coprosma microcarpa Hook. f.	Native coprosma
Aristotelia serrata (J. R. & G. Forst.) Okiv.	Wineberry
Dacrydium cupressinum Sol. ex Forst. f.	Rimu
Crataegus oxyacantha Linn.	Hawthorn
Fraxinus excelsior Linn.	Ash
Ribes grossularia Linn.	Gooseberry

Group 3.—Hosts with occasional oviposition areas.

Coprosma repens A. Rich.	Taupata
Myoporum laetum Forst. f.	Ngaio

Leptospermum ericoides A. Rich.	White manuka: kanuka
Quercus robur Linn.	English oak
Hebe speciosa (R. Cunn. ex. A. Cunn.) Cockayne et Allan	
Hebe salicifolia (Forst. f.) Pennell	Koromiko
Berberis darwinii Hook.	Barberry
Olearia spp.	
Pseudopanax crassifolium C. Koch	Lancewood
Fuchsia excorticata (Forst) Linn. f.	Tree fuchsia
Muehlenbeckia complexa (A. Cunn.) Meissn.	Pohuehue
Senecio perdicioides Hook. f.	Ruakumara
Acacia decurrens Willd.	Black wattle
Salix fragilis Linn.	Crack willow
Pittosporum eugenioides A. Cunn.	Tarata: lemonwood
Laburnum anagyroides Med.	Laburnum
Prunus sp.	Wild plum
Populus nigra L. var. *italica* Du Roi	Lombardy poplar
Ribes nigrum Linn.	Black currant
Solanum aviculare Forst. f.	Poroporo
Pomaderris sp.	Tainui
Polygala sp.	Milkwort
Abelia floribunda Decne.	
Chaenomeles lagenaria (Lois) Koidz.	Japonica
Leycesteria formosa Wall.	Himalayan honeysuckle
Hedycarya arborea Forst.	Pigeon wood
Brachyglottis repanda Forst.	Rangiora
Humulus lupulus Linn.	Hop
Melia azedarach Linn.	Bead-tree
Prunus lusitanica Linn.	Portugal laurel
Euonymus europaeus Linn.	Spindle-tree
Prunus spp.	Double flowering peaches
Ligustrum ovalifolium Haask.	Privet
Prunus sp.	Bronze plum
Rhododendron sp.	

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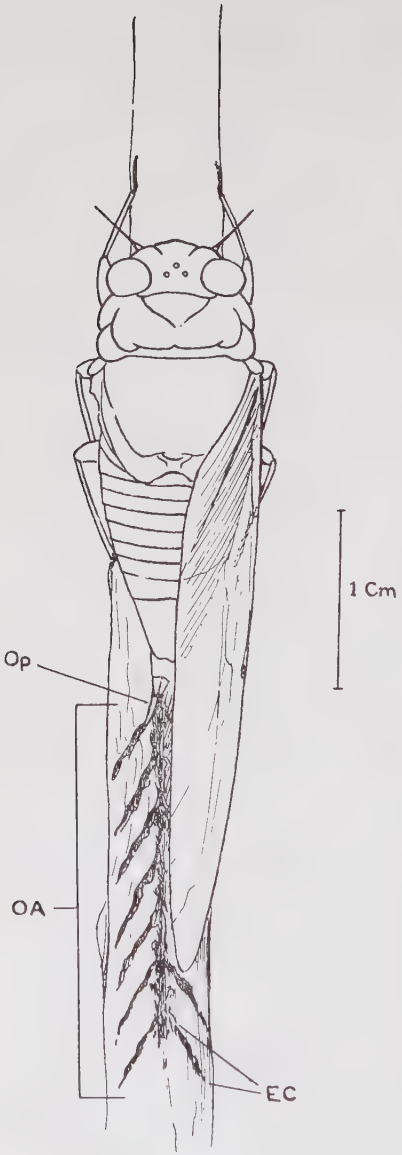

Fig. 1.—*Melampsalta cingulata* Fabr.

Adult female in act of oviposition. (Left wings removed to show abdomen.)

Op, ovipositor; OA, oviposition area; EC, egg chamber.

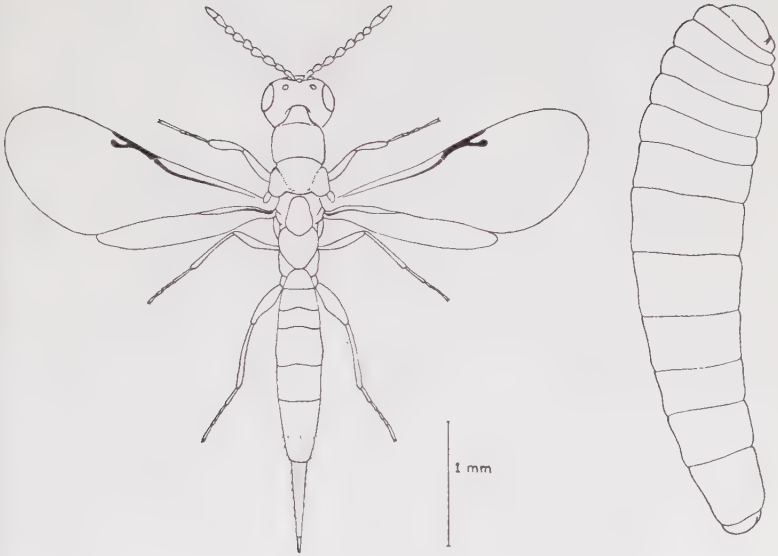

Fig. 2.—Hymenopterous parasite of *Melampsalta cingulata* Fabr. Left, adult female. Right, final instar larva.

Punched Cards: An Aid to Systematic Studies

By K. P. LAMB

Department of Scientific and Industrial Research, Plant Diseases Division, Auckland

[*Paper delivered to the Ent. Soc. of N.Z. Annual Conference, May 13, 1957, Rotorua.*]

Punched cards are widely used in industry as a convenient method of storing data in a rapidly accessible form. They are also used in taxation and census departments where one requirement is the rapid sorting of specific categories of information from a large mass of raw material.

I have found punched cards to be a valuable aid for rapid identification of trapped alate aphids from unknown host plants. The method has proved flexible and appears to have valuable potentialities as a tool in taxonomic studies.

In principle, the raw data are coded into cards which have a series of numbered holes around the circumference. Each card represents a single species, and each hole represents a unit of information, such as a morphological character or a systematic category. Where the character is present the outer rim of the hole is removed by means of a punch. Coded cards are stacked together, a needle is inserted through the appropriate hole, and all are lifted. The cards required then drop out. These are then needled again for another character, and so on, until a single card or group of cards remain, all of which share those characteristics which have been selected. The procedure is very rapid.

For aphid identification we have about 50 five inch by eight inch commercial punched cards, each one representing a species of winged aphid. The scientific name of the species concerned is written on the front of the card, together with a brief note of any salient peculiarities of the species. A total of 58 holes per card are used in this key, but an average card has eleven of these holes punched out.

Using these cards it is usually possible to run down a described species in a minute or two. It is much more rapid than the laborious use of keys. Furthermore, it is possible to select all the members of a particular subfamily or all those individuals with, say, swollen cornicles, or 6–10 sensoria on the third antennal segment, and so on. Identifications are of course checked against descriptions or specimens of the species concerned.

This has the advantage of being a sequential method of selection. That is to say, it can be stopped at any point where the identification is obvious. It automatically rejects all unacceptable species at each step and thus confines our attention to a more and more relevant group of species.

In taxonomic research this system may bring to light unsuspected affinities between species and should greatly speed up the construction of formal keys.

The success or otherwise of the method depends to some extent upon the initial coding of the data. However, it should not be difficult for a systematic worker to select morphological characters of systematic value for the group of animals concerned.

The speed, ease and flexibility of the method strongly recommend it for wider application to biological problems, whether quantitative or qualitative in nature.

A Strong Flight of *Charagia virescens* (Dbld.)

By J. I. TOWNSEND

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A strong flight of *C. virescens* (puriri moth) was observed at Ballance Bridge bush reserve, near Woodville, on November 27, 1956. Collecting was carried out between 7 p.m. and 10 p.m., the light source being a 500 C.P. petrol lamp, hung in front of a white tarpaulin.

Weather conditions during the day were partly overcast, but without rain. A strong wind was blowing but by evening this had dropped and rain threatened.

The first puriri moths appeared about 9 p.m., and from then on their numbers gradually increased until by 10 p.m. it was impossible for two collectors to handle the numbers arriving at the lamp. Forty-seven specimens were collected, almost all being in perfect condition, but the numbers observed in flight would probably be double this figure. All specimens taken were males, including three of the white mottled variety, *albo-extremus*, Quail. Shortly after 10 p.m. a violent thunderstorm developed. Despite the torrential rain and hail the moths continued to fly.

A collection at the same locality on the evening of November 21, yielded a total of twelve specimens, including one female and three *albo-extremus* males.

The handling of the moths was facilitated by hypodermic injections into the thorax of a small quantity of ethyl acetate. This produced immediate immobility, but the specimens were placed in a killing bottle to ensure ultimate death. This method did not appear to change their green colouring.

The Final Instar Larva of *Chlorochiton pulcher* (Broun) (Coleoptera, Scarabaeidae)

By J. M. HOY

Department of Scientific and Industrial Research, Entomology Division, Palmerston North

In the material examined, the final instar larva of *Chlorochiton pulcher* had an overall length of 37 mm, and a head capsule width of 5 mm.

Epipharynx. The epipharynx (Fig. 1) is similar in general shape to that of other described larvae of the genus *Chlorochiton*. The acroparia is well clothed with moderate length chaetae. The epizygum is incomplete, the zygum well defined and carries a series of two large and six small punctures. Six heli are arranged in an irregular, arched contiguous series. The chaetopariae are not as well developed as in *Chlorochiton discoidea* (Broun) with fewer chaetae and a much smaller number of punctures. The gymnopariae are large with a small number of bristles and few punctures. Each plegmatium carries twelve distinct plegma, which are slightly sinuous and decrease in length posteriorly. Cultriform acanthoparial bristles are present, one outside each plegma. Both the dexiotorma and the laeotorma are well developed and strongly chitinized, the pternotormal process smaller than that present in either *C. longicornis* Arrow or *C. discoidea*. Two nesia are present as in *C. suturalis* (Fab.). There are five large punctures in the dexiotormal region and a series of two large and three smaller punctures in the laeotormal area. The crepis is not distinct, two large and eighteen smaller crepidial punctures were counted. The pedium is asymmetrical, twice as long as broad, and free from punctures.

Mandibles. The mandibles (Fig. 2) carry, on the well defined scrobis, one long chaeta anteriorly, followed by two shorter and two moderate length chaetae. Two scrobal punctures are present. Four short chaetae occur in the dorso-molar region. There is one sensory pit on the dorsal posterior scissorial region, while anterior to this pit is a smaller puncture and a short stout chaeta. In the basolateral region there is a scattered group of seven punctures. In the ventro-molar region, extending on to the molar surface are approximately thirty minute punctures interspersed with minute bristles.

Raster. (Fig. 3.) The palidia are absent, the tegilla are medially

united, being made up of approximately forty apically hooked tegillar bristles. The rastal pattern is very similar to that of *C. discoidea.*

Material Examined. Two larvae collected at The Titan, 4,100 feet, in the Garvie Mountains in Southland, on November 12, 1955, by B. B. Given.

The writer wishes to thank Mr. B. B. Given for making this material available for description.

For explanation of the terminology see Hoy and Given (1952).

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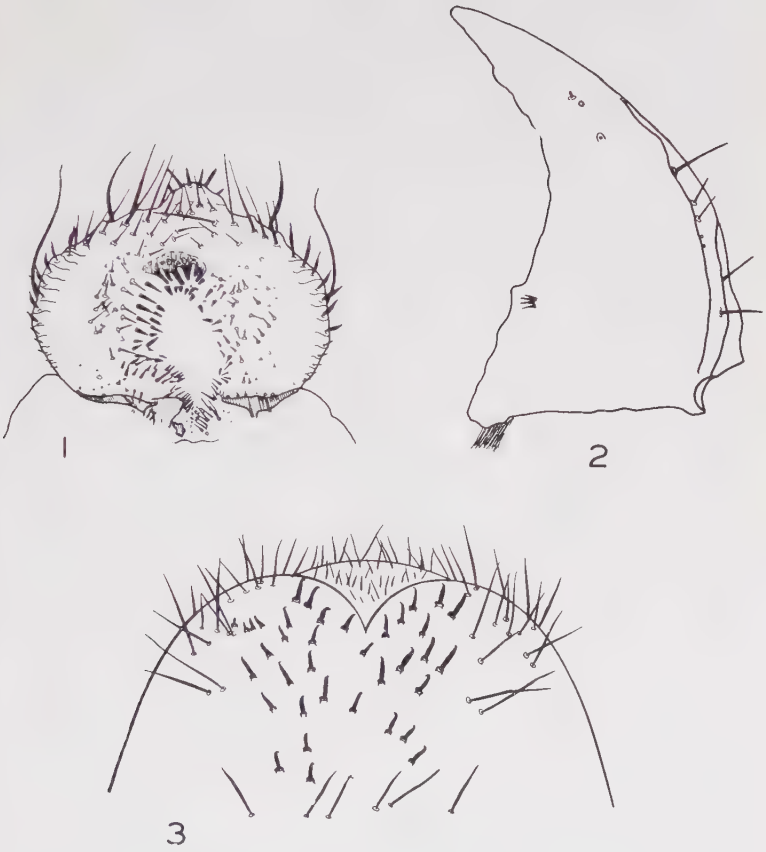


Fig. 1.—Final instar larva of *Chlorochiton pulcher* (Broun) (Coleoptera Scarabaeidae).

Hybridization Between Two Species of *Oxycanus* (Lepidoptera)

By J. T. SALMON, D.Sc., F.R.S.N.Z.

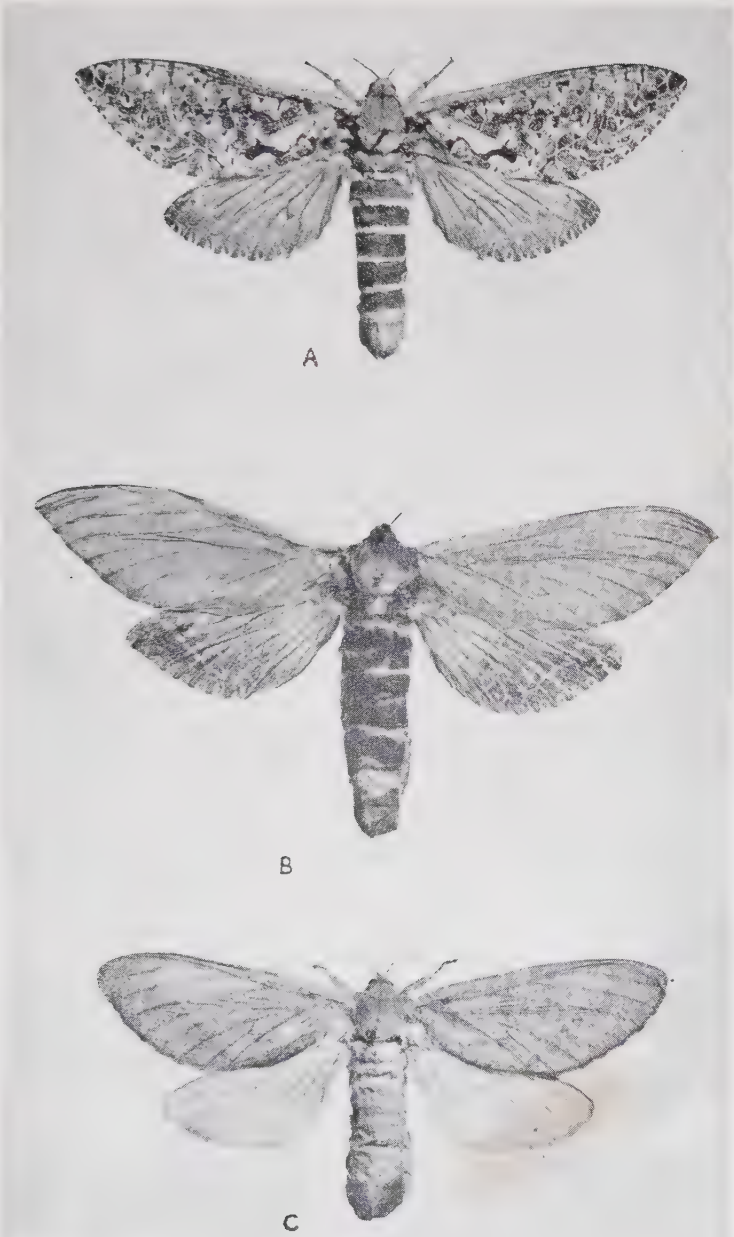
Victoria University College, Wellington, New Zealand.

The species of *Oxycanus* (*Porina*, Walker) occurring in New Zealand have never been reported as freely hybridizing. My purpose in this paper is to record a specimen which seems to indicate free hybridization between *Oxycanus characterifera* and *Oxycanus enysii*.

The specimen which I regard as a female hybrid form of *O. characterifera* was found resting on a beech tree trunk in broad daylight behind Days Bay on November 30, 1941, by Dr. R. R. Forster and myself. This specimen has the wing shape of *O. characterifera* but only the hind wings bear the colour and wing markings characteristic of this species. The expansion of the fore wings is 9·8 cm, and they are a medium golden brown colour with small white dots near the centre characteristic of certain female forms of *O. enysii*. The body bears the characteristic markings and colour of *O. characterifera*. The specimen was shown to the late Mr. G. V. Hudson about the time of capture, and he agreed with me that it represented a hybrid form between *O. characterifera* and *O. enysii*. Attempts to obtain similar specimens in the Days Bay locality in recent years have failed, and now I consider it is time to place this unique specimen on record in the hope that other collectors may be able to find further evidence of hybridization amongst these or other species of *Oxycanus* in New Zealand.

In the accompanying plate, Fig. A is a typical specimen of a female *Oxycanus characterifera*, Fig. B is the hybrid specimen from Days Bay, and Fig C is a typical specimen of *O. enysii* with orange brown fore wings and central white dots.

The hybrid specimen is preserved in the Dominion Museum collection in Wellington, and is placed with other specimens of *Oxycanus characterifera*.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Notes on *Opifex fuscus* Hutton (Diptera: Culicidae) and the Scope for Further Research On It

By ELIZABETH N. MARKS

Research Officer, National Mosquito Control Committee, Department of Entomology, University of Queensland

New Zealand's remarkable mosquito, *Opifex fuscus,* described by Hutton (1902) as a Tipulid, was placed in the Culicidae by Edwards (1921), who redescribed both sexes and drew attention to the peculiar modifications of the antennae and forelegs of the male. Miller (1922) gave more detailed descriptions, including also the larva and pupa, and Kirk (1923) gave a very full account of its unique mating habits. The pupa has since been figured in greater detail by Knight and Chamberlain (1948). Miller and Phillipps (undated) give the range of *O. fuscus* as the rocky coast line of the North Island and the northern part of the South Island; it breeds in saline pools above high water. No precise locality records appear to have been published, other than the original one of Wellington, and the sites marked on Graham's (1939) map. The genus *Opifex* is monotypic and confined to New Zealand. Miller (1922) erected a separate tribe for it, but Edwards (1924) did not regard this as justified. It shows strong affinities with the genus *Aedes.*

These notes have resulted from the examination of specimens in the Auckland Museum, and an evening spent collecting *O. fuscus* at Wellington and watching its behaviour in a cage.

Distribution. The known range of *O. fuscus* is extended both north and south by the following specimens in the Auckland Museum collection. Three Kings: Great I., April 17, 1946, 3 ♀♀ "biting sp. at landing (common)"; May 6, 1946, 2 ♀♀ "at camp"; January 11, 1951; 1 ♀ "beatings of *Coprosma* in gull colony", all coll. E. G. Turbott; Tasman Valley, Great I., January 5, 1953, 1 ♀ coll. G. Archey. Otago: Cape Saunders, February 24, 1918, 1 ♀. (Dr. E. P. Hodgkin and Mr. B. V. Fennessey informed me that they had seen mosquito larvae in rock pools on the outer coast of the Otago Peninsula in January, 1957; in view of the preceding record, it is likely that these were *O. fuscus.*)

Behaviour. On January 24, 1957, in rock pools at Island Bay, Wellington, adults of *O. fuscus* were collected just before dusk, skimming along the water surface, occasionally jumping or flying a short distance. These were placed in a 9in x 9in x 9in cage, with a bowl of pupae from the same site, and under artificial light, males

were observed to alight on the water and seize pupae. Kirk did not point out the great struggle that ensues between the male and the pupa, in which the male may lose his captive and be turned upside down on the water surface. He is able to right himself and sits on the water, the mid legs acting as the chief supports, while he removes the excess moisture by wiping the hind legs against one another, wiping the antennae, palps, proboscis and sometimes the hind legs with the fore legs, and wiping the wings with the hind legs. A pair in copula parted, and another male paired with the female on the water; she was also seized by two additional males, one gripping her neck with his claspers, and in the process the female was tumbled about on the water, but appeared to be able to right herself and dry herself also. In flight *O. fuscus* makes a sound more like the buzz of a fly than the usual high pitched note of a mosquito.

Morphology. Neither Edwards nor Miller remarked on the strong development of the scape and small size of the pedicel of the male antenna as compared with other species. In both sexes of *O. fuscus* proboscis, palps, antennae and tarsi are densely clothed with fine short hairs. Attention has not previously been drawn to a difference between the sexes –the femora and tibia of the female lack this vestiture but it is present on the fore femur and all tibiae of the male. The male terminalia are much more heavily sclerotised than in most mosquitoes.

P. F. Mattingly (1957) has recently observed that among *O. fuscus* larvae in the British Museum collection, received in 1921 from G. V. Hudson and collected at Wellington, some have pectinate hairs in the mouth brushes instead of all simple hairs as described by Miller. He suggests that this might be a case of balanced polymorphism leading to a fuller exploitation of the breeding places, and if so would be of considerable interest to geneticists. The total collection of larvae from Island Bay, Wellington, January 24, 1957, was examined, and found to comprise: (a) specimens with simple mouthbrushes, 44 4th instar (including 4 skins), 56 3rd instar, 28 2nd instar, 4 1st instar. (b) Specimens with pectinate mouthbrushes 17 4th instar, 7 3rd instar, 1 2nd instar. Of 4 4th instar larvæ from Breaker Bay, Wellington, March 23, 1944, Coll. W. J. Phillipps, 1 had simple and 3 had pectinate mouthbrushes. The different instars can be recognised by the width of the head capsule, which approximates 1·4 mm in 4th instar, 0·9 mm in 3rd instar, 0·5 mm in 2nd instar, and 0·3 mm in 1st instar.

Some Suggestions for Further Research

1. *Function of Male Antennae.* The male antennae in most mosquitoes are plumose and are the organs which enable the male

to locate the female in flight; the sound of her flight stimulates him to copulate (see Roth, 1948). The male antenna of *O. fuscus* lacks long hairs, but the second, third and fourth segment of the flagellum each bears a dorsal spine-like bristle; the pedicel, which contains the auditory organ, Johnston's organ, is reduced in size. Kirk describes males thrusting their heads below the surface to get a clearer view of the pupae. Does the antenna play any part in locating pupae by detecting vibrations in the water, and if so do mature pupae produce different vibrations from immature ones? Are males attracted to pupae of other species? In the laboratory, males may be attracted to fully emerged females resting on the water—what is the stimulus here?

2. Function of the glandular sac at the tip of the male palps (apparently this is not present in other genera).

3. *Rotation of male terminalia.* The terminalia of male mosquitoes rotate through 180° after emergence from the pupa; this usually takes 15—24 hours and mating cannot be successful until it has occurred. Kirk describes males of *O. fuscus* commencing to hunt pupae within 20 minutes of emergence. How long does rotation of the terminalia take and does it occur during or after emergence?

4. *Rate of wing beat.* From the sound made, it seems likely that this differs from most mosquitoes.

5. *Prevention of wetting.* Most mosquitoes would be drowned if subjected to a small amount of the tumbling in the water that adults of *O. fuscus* can survive, no doubt due to their hairiness, particularly of head, legs and abdomen. Is the action of these hairs mechanical, or have they any special hydrofuge properties?

6. *Source of energy. O. fuscus* males, soon after emergence, very actively seek mates and often have great struggles with the pupae they seize. Do they, as seems likely, require much greater reserves of energy than the average male mosquito, and if so what is the source (presumably in larval food) and method of storage of that energy.

7. *Morphology.* The peculiar modifications of the male antennae and forelegs, and the power required in the claspers for seizing and tearing the pupa suggest an interesting comparison of the musculature with that of a normal mosquito.

8. *Cannibalistic larvae.* Miller did not amplify his statement that the larvae were cannibalistic Do they feed only on dead bodies of other larvae (not an uncommon habit in mosquito larvae) or attack living larvae (a comparatively rare habit)? If the latter, what is the method of seizing and devouring their prey? In other

species which do this either the mouthbrushes, the mandibles or the maxillae may be adapted for seizing; the mouth-parts of *O. fuscus* do not appear to be specially modified. Do larvae of both types (of mouthbrushes) have the same cannibalistic habits?

9. *Two types of larvae.* What are the feeding habits of larvae with pectinate and with simple mouthbrushes? Is there any evidence that this is an example of balanced polymorphism? Do the proportions of the two types vary from pool to pool, or in different localities, or with the seasons, and if so can this be related to available foods?

10. *Relationships.* A detailed comparison of the chaetotaxy of all larval instars and of the pupa with representatives of the subgenera of *Aedes* that occur in the Australian region might throw light on the ancestral stock from which *Opifex* is derived and indicate in particular whether resemblances to *A. (Pseudoskusea) australis* are due to common ancestry or to convergence, possibly resulting from their similar habitats. The terminology for such a study has been provided by Belkin (1950, 1952, 1953, 1954).

11. *Behaviour.* A film of the mating behaviour of *O. fuscus* would be particularly instructive and should determine the range of functions of the modified forelegs and the reason for the differential distribution of hairs on the legs of the two sexes.

12. *Breeding places.* What is the range of salinity that the larva of *O. fuscus* can tolerate? Does it breed only on exposed shores or can it breed also in sheltered estuaries? (cf. *A. australis*).

Discussion. *O. fuscus* breeds all the year round in sites reasonably accessible to most of the major research institutions in New Zealand and is amenable to laboratory study. It therefore provides an excellent opportunity for further research. Any comparison of it with other mosquitoes would best be made with species of *Aedes*, the genus to which it appears most closely allied. As regards species from other habitats, *Aedes notoscriptus* (Skuse) and *Aedes antipodeus* Edwards are available in New Zealand, but a very interesting comparison could be made with *Aedes australis* (Erichson) (= *concolor* Taylor), which inhabits corresponding breeding sites on the rocky shores of Australia (distribution and references in Mattingly and Marks (1955)). Woodhill (1936) has shown *A. australis* to be suitable for laboratory study.

Previous authors have not suggested the significance of the modifications in structure and behaviour of *O. fuscus*. They appear to be adaptations to life on wind and spray swept rocky coasts where males emerging 24 hours before the females, or adults mating in flight might be blown far from their breeding places. *A. australis*, which shows no such specialisation, inhabits similar sites in Aus-

tralia but can breed also in sheltered estuaries and in water of low salinity.

The literature does not indicate whether *O. fuscus* ever breeds in sheltered sites. There might also be a difference in the amount of shelter for adults provided by vegetation in the vicinity of breeding places of the two species, which would help to account for the different degrees of specialisation to the habitat.

Acknowlegements. I am grateful to Dr. G. Archey and Mr. E. G. Turbott for the opportunity to examine specimens in the Auckland Museum, to Mr. J. Yaldwyn for directing me to the Island Bay locality and to Miss K. A. Walker for assistance in collecting.

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Notes on Insect Pests, 1956-57

By K. A. J. WISE

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The following notes are new or otherwise interesting records of insects sent to the Plant Diseases Division during 1956–57.

Lepidoptera

Aglossa caprealis (Hb.) (Pyralidae)

Adults were reared from larvae infesting bean seed at Ranui, Henderson, September, 1956 (P. B. Hannken coll.).

Agrotis ypsilon (Hfn.) (Noctuidae)

In February, 1957, larvae were reported damaging carrots (*Daucus carota* L. var. *sativa* DC.) and beetroots (*Beta vulgaris* L.) in Gisborne (Agriculture Department); and young swedes (*Brassica napo-brassica* Mill.) in Te Awamutu (Te Awamutu Farm Improvement Club). Several cases of damage to potato tubers (*Solanum tuberosum* L.) occurred in Auckland during this season.

Bedellia somnulentella Zell. (Lyonetiidae)

Larvae were leaf-mining on several widely separated plantings of kumaras (*Ipomoea batatas* Lam.) in the Hastings area in January, 1956 (Agriculture Department), and, subsequently, kumara leaves at the Plant Diseases Division were found to have a light infestation.

Charagia virescens (Dbld.) (Hepialidae)

Larvae were discovered ring-barking and boring in escallonia (*Escallonia macrantha* Hook and Arn.) at Waitara in June, 1957. They had by then killed two plants of a hedge (Agriculture Department).

Gnorimoschema operculella (Zell.) (Gelechiidae)

Adults were reared from larvae found boring in egg-plant fruits (*Solanum melongena* L.) at Clive in April, 1956 (Agriculture Department). Most fruits of a small planting were affected.

Phalaenoides glycinae Lew. (Agaristidae)

This species was first recorded on fuchsia (*Fuchsia* sp. cult.) by Wise (1956). Two further infestations on this host were found in Auckland in November, 1956 (R. Nodder coll.) and February, 1957 (Mrs. A. Fisher coll.).

Coleoptera

Anthrenus vorax Waterh. (Dermestidae)

Numerous adults and larvae were collected from bedding and clothing in the crew's quarters of a motor vessel, from Japan, in Auckland, in January, 1956 (Health Department). This species has not been recorded in New Zealand.

Rhantus pulverosus Steph. (Dytiscidae)

Many adults were found in and around mineral pools at Hanmer Springs in February, 1956 (Agriculture Department). They were a nuisance to swimmers, who reported being "stung", presumably bitten. Although the baths were cleaned weekly the infestation continued until heavy rains occurred, after which the beetles disappeared. It is thought that beetles sought the mineral pools because of lack of water elsewhere, due to drought.

Hymenoptera

Vespula germanica (F.) (Vespidae)

One specimen was taken at Dunedin in January, 1956 (Agriculture Department), and several at Dumbarton, Roxburgh, in April, 1957 (Agriculture Department). As far as is known these are first records for the districts.

Hemiptera

Acantholybas brunneus Bredd. (Coreidae)

In February, 1957, this species was found on arum lily (*Zantedeschia aethiopica* Spreng.) (Miss A. Richards coll.) and in large numbers on rhubarb (*Rheum rhaponticum* L.) (J. Beever coll.) in Auckland. Both are probably food-plants; rhubarb has previously been recorded by Woodward (1953). The occurrence on arum lily, which is common in Auckland, may account for the presence of *A. brunneus,* often in large numbers, in many parts of the district. Very large numbers were swarming on trunks of silver birch and peach trees in an Auckland garden in April, 1956.

Specimens in the Plant Diseases Division collection have been taken in previous years from pumpkin, beans, and lettuce, but it cannot be assumed that these are hosts.

Lygaeid bugs (Lygaeidae) on strawberries.

A heavy infestation of adults and nymphs occurred on strawberries (*Fragaria* sp. cult.) at Foxton in February, 1956 (Agriculture Department). It was reported that the bugs were sucking the fruit.

Dr. T. E. Woodward, University of Queensland, Australia, has

identified *Nysius huttoni* White (9 specimens) and *Pachybrachius nigriceps* (Dall.) (1 specimen).

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Beetle Relaxing Fluid

By BRENDA M. MAY

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Most entomologists are familiar with the beetle relaxing fluid developed at the United States National Museum by H. S. Barber and others, and recommended by J. M. Valentine in his paper on preparation of coleoptera (1934).

One formula which has been used with considerable success at the Plant Diseases Division is given as follows:—

Alcohol 95%	265	parts
Water (distilled)	245	"
Ethyl acetate	95	"
Benzene	35	"

If, when making up, the mix should separate into two layers or the mixture remain cloudy, absolute alcohol may be added, a few drops at a time, with gentle shaking until the fluid is clear.

Beetles killed in this fluid are relaxed completely and the genitalia extruded after soaking for about twelve hours. Specimens may be pinned immediately on removal since evaporation is rapid and setae, pubescence, antennae and other small appendages spring readily back into position. Those requiring to be mounted with adhesive are best left until dry. Colours are not affected.

It has also been found that the fluid is invaluable for rejuvenating old specimens Soaking for half an hour relaxes dry specimens sufficiently for handling, resetting or repinning. Light mould patches and grease are removed and most mounting adhesives in common use are softened or dissolved. Individual limbs or joints can be loosened to allow movement without injury by the local application of a single drop of fluid. This is sometimes necessary when pinned specimens are being examined.

The most usual application is to coleoptera, but orthoptera, hemiptera, diptera and hymenoptera have also been relaxed by the fluid, although care had to be taken that the edges of wings did not fold over. It has been used successfully on phorids and drosophilids but flies smaller than these and tiny hymenopterans fold up while being removed from the liquid and are difficult to straighten out when dry.

A Note on Two Diseases Attacking *Persectania aversa* (Walk.) in the Field

By A. D. LOWE

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Brief reference has already been made to disease attacking the larvae of the native armyworm *P. aversa** under field conditions (Lowe, 1956).

In August, 1954, a single diseased caterpillar of this species was collected at Fairton, near Ashburton, and it was noted that symptoms were similar to those illustrated by Lower (1954) as typical of a disease attacking *P. ewingii* (Westwd.) in South Australia.

In February, 1955, in a field of barley at Alford Forest, near Ashburton, large numbers of diseased larvae were collected. On this occasion, the disease appeared to differ from that observed earlier, and specimens of both were submitted to Mr. H. F. Lower, Waite Institute, Adelaide, Australia. The following report was received from him: "The specimens from Alford Forest were attacked by a granulosis virus similar to that which caused such high mortality in the occurrence I reported. It is possibly the same virus, but at present I am unable to verify this."

Of the specimen collected at Fairton, Mr. Lower said, "This insect had not died from the virus, but from a fungous disease . . . which I have not been able to identify as yet."

Since these specimens were taken, disease has been noted among such larvae in many places, including a very high incidence among caterpillars collected at Mt. Highfield (2,200ft) near Waiau, North Canterbury, from *Nassella trichotoma* (Nees) Hack. Of 104 specimens collected, only six appeared healthy.

* Referred to as *P. composita* Guen.

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The Brookes Collection

(NEWS ITEM)

In 1955 the Department of Scientific and Industrial Research purchased the insect collection of the late Albert E. Brookes. This collection, predominantly coleoptera, contains perhaps 35,000 specimens two thirds of which are New Zealand, a third foreign. The New Zealand material comprises perhaps 25,000 specimens of coleoptera, a thousand specimens of lepidoptera and a few trays of miscellaneous insects such as wetas and cicadas. The foreign material follows the same pattern. There are some foreign butterflies (some curiously having the body replaced with painted paper cutouts) and a few gaudy or spectacular specimens of other orders but the great bulk is coleoptera. These were obtained by Brookes by exchange with well known collectors or taxonomists and hence the material is mostly named, often by the author of the species. Unexpectedly, there is a fair sprinkling of type material. As an example, the weevil collection contains 880 named species in 360 genera, with 28 cotypes. Although the foreign collection is but a small portion of world species it should prove valuable for identification of introduced and quarantine material and for generic and subfamily comparison.

Without doubt the Brookes collection of New Zealand beetles contains more specimens, and more species from more localities than any collection that has ever been formed, excepting only the fabulous collection of Major Broun. Much of the material was collected by Brookes himself but many rare or interesting specimens were sent by other collectors as gifts or in exchange. Of special interest is the fact that the collection contains considerable material authenticated by Broun, and as much of this is part of the type series or from type localities, the usefulness is obvious.

Much of the Brookes material is still on rough cards awaiting mounting, labelling and sorting. Until this task is finished (and it may well take several years) it is impossible to predict whether amalgamation of Brookes material with D.S.I.R. collections will result in substantially complete representation of known species, but indications are that this may be so, for at Auckland, where the Brookes Cerambycinae have been incorporated into the Division's collection this now contains forty-eight of the fifty-five described endemic species.

After purchase the collection was moved to the Plant Diseases

Division, Auckland, but as it has now been partitioned between that Division and the Entomology Division, Nelson, it seems desirable to place on record the present location of the various groups. All material other than coleoptera remains at Plant Diseases Division. The Entomology Division has all the New Zealand coleoptera other than the subfamily Anobiinae and the superfamilies Elateroidea, Scarabaeoidea, Cerambycoidea and Curculionoidea. Foreign coleoptera will be partitioned in the same way. But this partition of material is not absolute for it is intended that there should be free interchange of surplus specimens between the two Divisions so that ultimately both Divisions will have strong collections of the whole order.

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CONTENTS

	Page
EDWARDS, J. S.: *Plusia chalcites* on *Tecomanthe speciosa*	1
ARMSTRONG, J. S.: Notes on *Ischnura aurora* (Brauer), Odonata	2
HARFORD, MISS B.: Observations on some Habits and Early Development of *Melampsalta cingulata* (Fabr.) (Order Hemiptera, Family Cicadidae)	4
LAMB, K. P.: Punched Cards: an Aid to Systematic Studies	12
TOWNSEND, J. I.: A Strong Flight of *Charagia virescens* (Dbld.)	14
HOY, J. M.: The Final Instar Larva of *Chlorochiton pulcher* (Broun) (Coleoptera, Scarabaeidae)	15
SALMON, J. T.: Hybridization between Two Species of *Oxycanus* (Lepidoptera)	18
MARKS, MISS E. N.: Notes on *Opifex fuscus* Hutton (Diptera: Culicidae) and the Scope for Further Research on it	20
WISE, K. A. J.: Notes on Insect Pests, 1956-57	26
MAY, MISS B. M.: Beetle Relaxing Fluid	29
LOWE, A. D.: A Note on Two Diseases Attacking *Persectania aversa* (Walk.) in the Field	30
NEWS ITEM: The Brookes Collection	31

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